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1,149,332

PATENT SPECIFICATION

DRAWINGS ATTACHED

1,149,332

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Int. Cl.:—**H 01** r 43/00.

COMPLETE SPECIFICATION

Electrical Contact Pins and Method Of Manufacture

We, AMP INCORPORATED, a corporation organised and existing under the laws of the State of New Jersey, United States of America, of Eisenhower Boulevard, Harrisburg, State of Pennsylvania, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

This invention relates to electrical contact pins and to their method of manufacture and is particularly useful in the production of pins of very small size for which there is a requirement where multiple connections are required to be made in a very small space.

Electrical contact pins are generally of one of two types. A first type concerns rigid pins which fit in resilient sockets and generally comprise a solid rod of metal. Arrangements of this first type rely essentially on the resilience of the socket to obtain electrical contact pressure. Although such rigid pins can be made in very small sizes, it becomes difficult to manufacture adequately resilient sockets of size sufficiently small to take advantage of the small pin size. A second type comprises a resilient pin for insertion in a rigid or a resilient socket where electrical contact pressure depends primarily, or to a substantial extent, on resilient flexure of parts of the pin. With assemblies of the second type it is possible to make relatively rigid sockets of small size so that close pitch spacing of sockets in an insulated matrix can be obtained, but it becomes increasingly difficult to manufacture satisfactory pins with decreasing size.

As a result there is an unsatisfied requirement for resilient electrical contact pins of sufficiently small size for use in releasable multiple pin and socket connectors at close pitch. For example, such a requirement exists in the computer industry where circuitry components have been reduced in size to such an extent that current circuitry interconnections occupy a large volume relative to the volume of circuitry and to the whole equipment. With the practical need to reduce the overall size of the computer equipment there is a pressing need for reduction in the size of the interconnections. It is desirable to employ releasable interconnections to facilitate assembly and servicing.

According to the present invention a method of manufacturing an electrical contact pin from metal bar or wire stock of substantially uniform section comprises a first step of flattening a short length of the bar stock to form a portion of reduced thickness and increased width in relation to the adjacent unflattened bar stock and a second step of spacing parts of the flattened portion in generally parallel relation longitudinally of the stock, whereby the spaced parts project externally of the peripheral envelope of the bar or wire stock and are capable of resilient flexure towards that envelope.

The spaced parts may be defined by slotting the flattened portion or by forming it into a cylindrical or part cylindrical configuration or by a combination of these measures.

The invention includes an electrical contact pin comprising a length of solid metal bar stock of substantially uniform cross-section having a flattened portion of reduced thickness with parts of the flattened portion spaced apart in generally parallel relation extending longitudinally of the stock, the spaced parts projecting externally of the peripheral envelope of the stock and

being capable of resilient flexure towards that envelope.

The invention will now be described by way of example with reference to the accompanying, partly diagrammatic drawings, in which:—

Figure 1 is a fragmentary prespective view of an end portion of a piece of round bar or wire stock after an initial forming operation;

Figure 2 is a view similar to that of Figure 1 of the portion after a flattening operation;

Figure 3 is a view similar to that of Figures 1 and 2 of the portion after a further operation on the flattened portion;

Figure 3A is a cross-section taken on line 3A-3A of Figure 3 looking in the direction of the arrows;

Figure 4 is a view similar to that of Figures 1 and 2 of the portion after a slitting operation alternative to the operation of Figure 3;

Figure 4A is a cross-section taken on line 4A-4A of Figure 4;

Figure 5 is a view similar to that of Figure 4 of the portion after a further forming operation;

Figure 5A is a cross-section taken on line 5A-5A of Figure 5 viewed in the direction of the arrows;

Figure 6 is a fragmentary perspective view of a bar portion after an alternative forming operation to that of Figure 4;

Figure 7 is a fragmentary view of the pin of Figure 6 after a further operation;

Figure 8 is a fragmentary perspective exploded partly sectioned view of a pin and socket connector assembly embodying a pin of the form shown in Figures 5 and 5A; and

Figure 9 is a sectional side view to an enlarged scale of the assembly of Figure 8 showing different conditions of insertion of adjacent pins.

In the embodiment of Figures 1 to 3A an electrical contact pin is formed at an end portion of round metal wire stock 1. In an initial forming operation the end 2 of the length of wire is tapered in generally frusto-conical manner, suitably by press-forming, to define a tapered nose. In a second forming operation a portion 3 of the wire is flattened, suitably by a cold forging or stamping operation, to define a flattened portion 3 of reduced thickness and increased width in relation to the undeformed cross-section of the wire. The flattening is suitably performed in dies arranged to control the shape of the flattened portion 3 and present smoothly contoured transitions 4 between the flattened portion 3 and the adjacent portions 5, 6 of wire of circular cross-section. The partly formed contact pin of Figure 2 is then subject to a further forming operation which comprises folding the flattened portion 3 into generally U- or C-section as shown in Figures 3 and 3A, with side parts 7 of the flattened portion arranged in generally parallel spaced relationship extending longitudinally of the wire length and projecting externally of the notional peripheral envelope of the wire 1. The notional envelope of the wire has the configuration of Figure 1, i.e. that enveloped described by projecting the undeformed cross-sectional configuration of the wire through the length of formed portion 3, and the side parts 7 project externally of this envelope configuration as seen in Figure 3A, so that they are capable of resilient flexure towards each other towards this configuration by closing of the U or C configuration.

The pin of Figure 3 is thus capable of a resilient fit with a cylindrical rigid socket having a bore in which the undeformed portions 5 and 6 are a free sliding fit. The tapered nose 2 facilitates insertion of the pin into the socket and the undeformed portion 5 facilitates alignment of the pin axially of the socket during initial insertion. The side parts 7 are resiliently flexed inwards by engagement with sides of the socket as the pin is pushed further into the socket and the portions 5 and 6 serve to stabilise the pin against tilting which might overstress the side parts 7.

In an alternative pin construction, after the stage of Figure 2, the flattened section may be slotted at 8 as shown in Figure 4, centrally of the flattened portion. The slot 8 extends axially relative to the wire substantially throughout the length of the flattened portion 3 to define on opposite sides of the slot 8 arms 9 which at their outer edges project externally of the peripheral envelope of the wire.

The arms 9 are capable of resilient flexure towards each other by closing of this slot 8 and the pin is useful in this form. Preferably, as shown in Figure 4A, the outer edges of the arms 9 are convexly rounded as shown at 10 in Figure 4A to facilitate smooth engagement with sides of a complementary socket.

As an alternative to the construction of Figure 4A, the arms 9 may be folded as shown in Figures 5 and 5A in a further forming operation so that in cross-section, as seen in Figure 5A, they extend arcuately, concentrically with the circular wire cross-section with greater effective external diameter. In this construction the arms 9 are capable of flexure by inwards movement towards each other and by bending in cross-section to reduce their cross-sectional curvature.

In an alternative to the construction illustrated in Figures 4, 5 and 5A, the flattened portion may be provided with a plurality

of spaced slots 8 to define several arms 9. For example, as shown in Figures 6 and 7, two parallel slots 8 may be formed to define three spaced parallel arms 9, the flattened portion 3 subsequently being rolled up into a generally cylindrical form coaxial with the wire and presenting three resilient arms 9 distributed circumferentially around the pin profile and projecting externally of the envelope defined by the undeformed wire portions.

Figure 8 shows a pin 11 of the form disclosed in Figures 5 and 5A with its undeformed wire portion 6 secured in an insulating block 12 with the resilient section defined by arms 9 disposed forwardly of the block 12. The pin 11 is insertable in a socket 13 defined by an aperture 14 in a printed circuit board 15, side walls of the aperture 14 being plated with a metal layer 16. The plated aperture 14, 16 presents a cylindrical bore of uniform internal diameter within which the undeformed portions 5, 6 of the pin are a free sliding fit.

As evident from Figure 9, the frusto-conical nose 2 facilitates entry of the pin into the socket and the portion 5 serves to ensure axial alignment of the pin with the socket before the resilient section defined by arms 9 penetrates the socket. Figure 9 shows a pair of sockets side by side. The lower socket has a pin after further insertion than the condition of the pin in the upper socket, and the arms 9 have been resiliently deflected by engagement with the sides of the socket as the pin has been inserted, partially to close the slot 8.

Whilst the embodiments disclosed are formed from wire or bar stock of circular cross-section, similar constructions are possible using bar stock or wire of other cross-section. The construction of the pins may be performed on a wire such that the wire extends rearwardly of the resilient pin portion for connection to some remote point. Alternatively the pin may comprise a short length of bar or wire stock which at the rear end of portion 5 is connected to a circuitry wire. Connection may be by any suitable technique, for example soldering, welding, crimping, wrapping or a clip-type connection technique.

WHAT WE CLAIM IS:—

1. A method of manufacturing an electrical contact pin from metal bar or wire stock of substantially uniform cross-section which comprises a first step of flattening a short length of the stock to form a portion of reduced thickness and increased width in relation to the adjacent unflattened stock and a second step of spacing parts of the flattened portion in generally parallel relationship longitudinally of the stock whereby the spaced parts project externally of the peripheral envelope of the bar or wire stock and are capable of resilient flexure towards that envelope.

2. The method of claim 1, in which the second step is performed by folding the flattened portion into a hollow U- or C-section.

3. The method of claim 1, in which the second step is performed by slotting the flattened portion to define at least two arms.

4. The method of claim 3, in which the flattened portion after slotting is folded into a cylindrical or part cylindrical configuration coaxial with the stock.

5. The method of claim 1, in which an end portion of the stock is tapered in generally frusto-conical manner.

6. An electrical contact pin comprising a length of metal bar or wire stock of substantially uniform cross-section in which a flattened portion of reduced thickness and increased width has spaced parts arranged in generally parallel relation extending longitudinally of the stock, projecting externally of the peripheral envelope of the stock, and being capable of resilient flexure towards that envelope.

7. A contact as claimed in claim 6, in which the flattened portion is disposed intermediate undeformed portions of the stock.

8. A contact as claimed in claim 7, in which an end portion of the stock is tapered in generally frusto-conical manner.

9. A contact as claimed in claim 6, in which the flattened portion is folded into generally U- or C-cross-section.

10. A contact as claimed in claim 6, in which the flattened portion is slotted longitudinally to define at least two generally parallel, spaced arms.

11. A contact as claimed in claim 10, in which the slotted flattened portion is formed into a cylindrical or part cylindrical configuration coaxial with the stock.

12. A method as claimed in claim 1 and substantially as described with reference to Figures 1, 2, 3 and 3A, or 1, 2, 4 and 4A, or 1, 2, 4, 5 and 5A, or 1, 2, 6 and 7 of the accompanying drawings.

13. An electrical contact substantially as described with reference to Figures 3 and 3A, or 4 and 4A, or 4, 5 and 5A, or 6 and 7 of the accompanying drawings.

For the Applicants:
R. G. STUART-PRINCE,
Chartered Patent Agent.

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FIG.1.

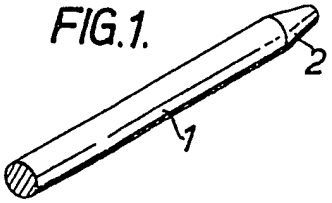


FIG.2.

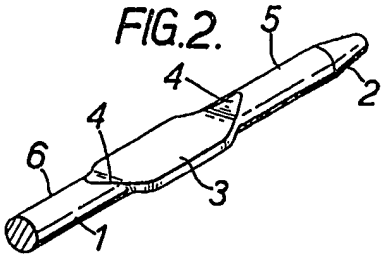


FIG.3.

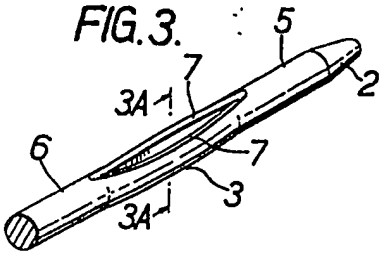


FIG.3A.

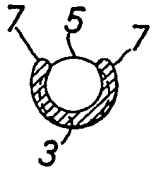


FIG.4.

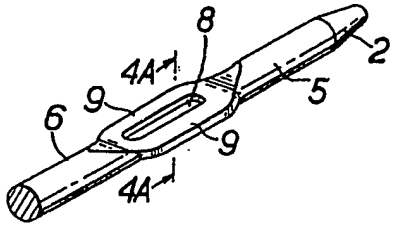


FIG.4A.

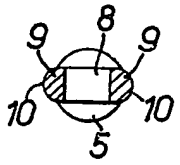


FIG.5.

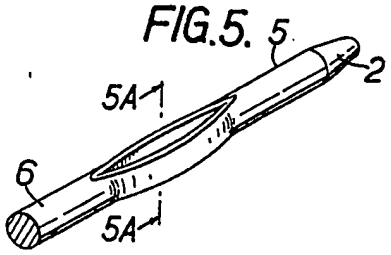
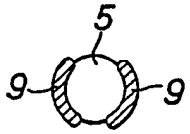


FIG.5A.



1,149,332 COMPLETE SPECIFICATION
2 SHEETS This drawing is a reproduction of the Original on a reduced scale.
SHEETS 1 & 2

FIG.6.

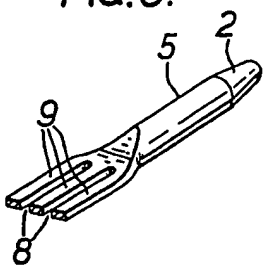


FIG.7.

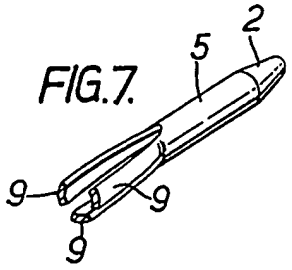


FIG.8.

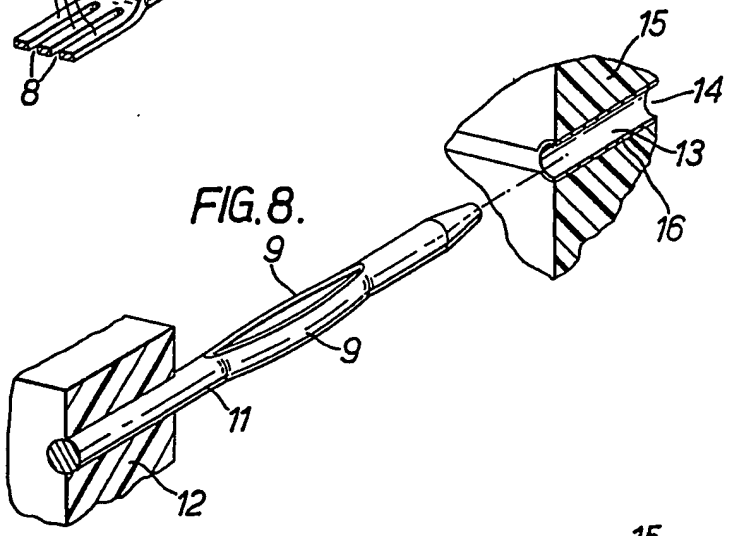
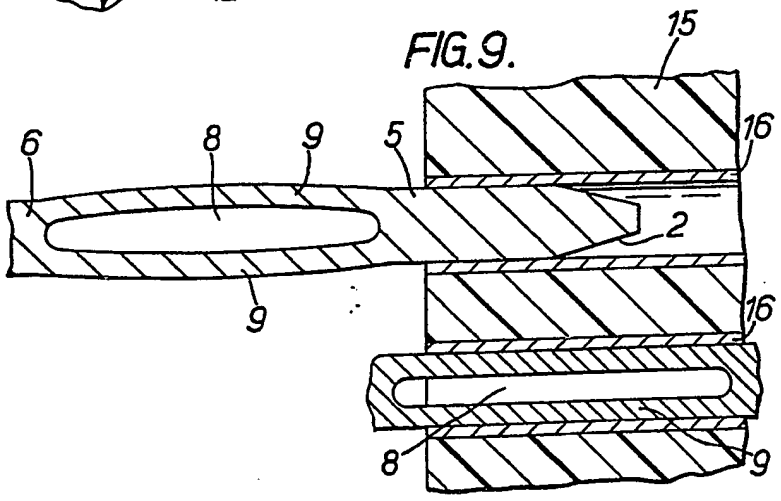


FIG.9.



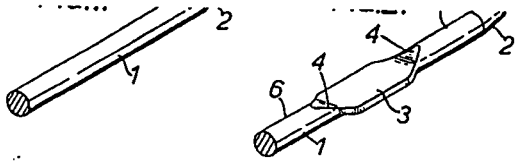


FIG.3.

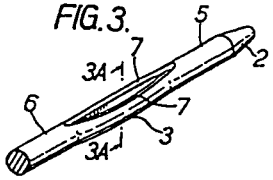


FIG.3A.

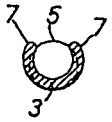


FIG.4.

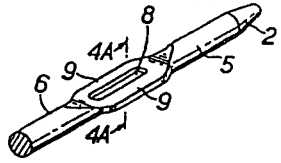


FIG.4A.

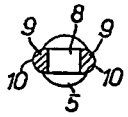


FIG.5.

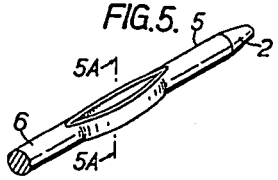


FIG.5A.

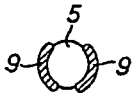


FIG.6.

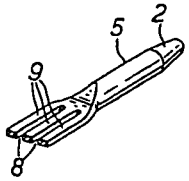


FIG.7.

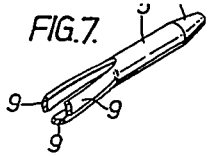


FIG.8.

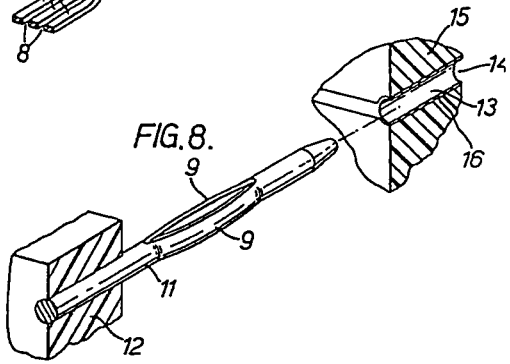


FIG.9.